ENERGY BUILDING CERTIFICATION IN PRACTICE

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ABSTRACT

This paper entitled "Energy building certification in practice" deals with the new standard EN 15 193 and software support to ease building assessment.

1 INTRODUCTION

According to the aim of European Union to improve efficiency of electric energy consumption in buildings, several standards were published during last year. [1]

The main goal of these standards is to assess energy consumption. Buildings assessed according to this methodology are divided into several groups (A, B, …., G), according to the efficiency of the whole building. This assessment includes several fields and the lighting is one of these fields.

But, from the point of view of users, the usage of this standard is a bit complicated and the software support is necessary.

2 ENERGY PERFORMANCE FOR LIGHTING

The main goal of this standard is to establish conventions and procedures for the estimation of the energy requirements of lighting in buildings and also give a methodology for a numeric indicator of energy performance of building. [2]

At the beginning, it is necessary to write, that there are several methods, how to assess energy performance:

- Quick method
- Comprehensive method
- Measurement of lighting circuit

The comprehensive method is used for building certification. In this article we would like to show, how to use energy assessment in the field of energy consumption of lighting.

2.1 Example

In this example the classroom is room calculated according the standard.

Room

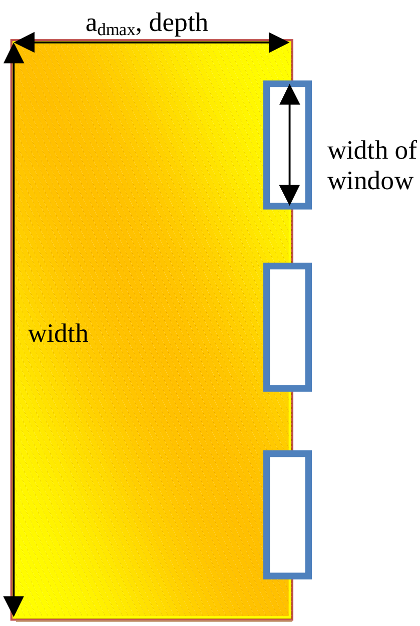
- Height = 2,6 m
- Width = 7,5 m
- Depth = 4,5 m
- Work plane - height 0,8 m

Windows, double glazed (standard values acc. to the EN)

- Height 2 m
- Width 1,5 m
- Height above a floor 0,8 m

Lights

- 6 x Philips Fines TCS 198 2xTL-D36W/840 HF C6 (P_i = 72 W)



Maintenance factor 0,8.

Maintained illuminance according to the EN 12 464 [3], 500 lx.

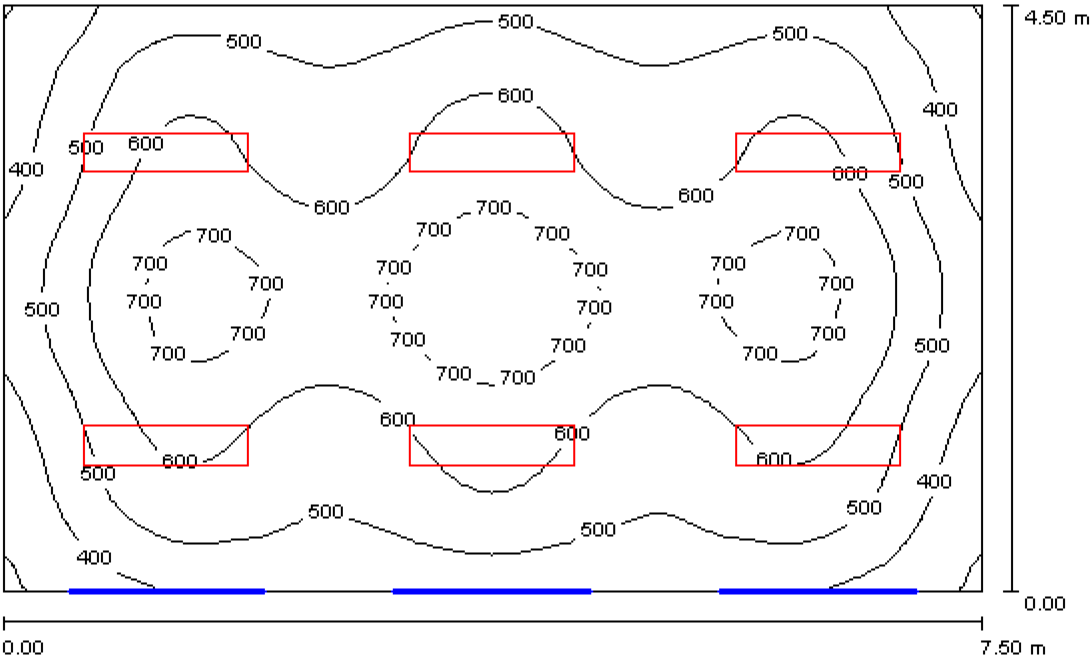


Fig. 1 Illumination of the classroom (example)

Surface	ρ [%]	E_{av} [lx]	E_{min} [lx]	E_{max} [lx]	u0
Workplane	/	559	285	763	0.51
Floor	20	485	277	677	0.57
Ceiling	70	88	62	102	0.71
Walls (4)	50	189	57	369	/

Fig. 2 Result of the illumination

2.2 Comprehensive method –

2.2.1 Total useful floor area of the building

$A = a \cdot b = 7{,}5\ m \cdot 4{,}5\ m = 33{,}75\ m^2$

2.2.2 Area of carcass openings:

$A_c = 9\ m^2$.

2.2.3 The maximum possible depth of zone

$a_{Dmax} = 2{,}5 * (2{,}8 – 0{,}8) = 2{,}5 * 2 = 5$, but depth of the room is 4,5 m. $a_{Dmax} = 4{,}5$ m.

2.2.4 Daylight space

$A_D = 33{,}75\ m^2$.

2.2.5 Transparency index

$I_T = A_C/A_D = 9 / 33{,}75 = 0{,}266$ [-]

2.2.6 Depth Index

$I_{De} = 4{,}5 / 2 = 2{,}25$ [-]

2.2.7 Obstructions

2.2.7.1 The correction factor for linear obstructions
I_{OOB} = cos(1,5 . 30) = 0,707 [-]

2.2.7.2 The correction factor overhang
I_{OOV} = cos(1,33 . 30) = 0,767 [-]

2.2.7.3 The correction factor for vertical fins
I_{OVF} = 1 – 30/300 = 1 – 0,1= 0,9 [-]

2.2.7.4 The correction factor courtyard and atria;
I_{OCA} = 1 [-]

2.2.7.5 The correction factor for glazed double façades
I_{OGDF} = 1 [-]

$I_O = I_{OOB} \cdot I_{OOV} \cdot I_{OVF} \cdot I_{OCA} \cdot I_{OGDF} = 0{,}488$ [-]

2.2.8 Daylight factor

D_C = (4,13 + 20. 0,266 – 1,36.2,25) . 0,488 = 3,125 [%]

2.2.9 Daylight factor classification

$D = D_c \cdot \tau_{D65} \cdot k_1 \cdot k_2 \cdot k_3$ = 3,125 . 0,82 . 0,78 . 0,8 . 0,73 = 1,167 [%] = WEAK

2.2.10 Daylight supply factor (for 500 lx)

$F_{D,S} = a + b \cdot \gamma_{site}$ = 0,9432 – 0,0094 . 48,7066666666667 = 0,484793

2.2.11 Detailed determination of F_O

F_{OC} = 1 – the lighting is switched on centrally

2.2.11.1 Absence factor
F_A =0,25 – classroom

According to the equation (D.4), $F_O = F_{OC} + 0{,}2 - F_A = 0{,}95$ [-]

2.2.11.2 Daylight dependent artificial lighting control
F_{DC} according to the table C.9 for manual control and daylight penetration (WEAK) equals 0,2.

2.2.11.3 Daylight dependency factor
$F_D = 1 - F_{D,S} \cdot F_{D,C}$ = 1 – 0,484.0,2 = 0,9029 [-]

2.2.12 LENI INDEX CALCULATION

$$W_{L,t} = ((Pn \cdot Fc)((t_D \cdot F_o \cdot F_D) + (t_N \cdot F_o)))/1000 = ((6.72.1)((1800 \cdot 0{,}95 \cdot 0{,}9029) + (200 \cdot 0{,}95))) / 1000 = 749{,}070 \text{ kWh}$$

LENI = W/A = 749,070 / 33,75 = 22,195kWh /m^2.year

LENI = 23 kWh/m^2.rok

3 CONCLUSION

This article briefly describes process of LENI index calculation. It is necessary to write, that in this standard some combinations are not solved and the standard is too complicated. The main goal of the standard is the effort to influnce prices, but if there is lack of competitive buildings, the assessment has no influence on the prices of buildings and energy consumption. It can be said, that energy building certification has no effect on prices and it is a new excess of the European Union without any effective consequences on the over-consumption.

4 *REFERENCES*

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[2] EN 15193: Energy performance of buildings — Energy requirements for lighting

[3] EN 12464-1, Light and Lighting – lighting of workplaces – Part 1: Indoor work places

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